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ABSTRACT

Thirteen elementary and four middle schools in a large, suburban district are compared by level of instructional expenditure and socioeconomic status of the community served by each school. Regression analysis is utilized to determine the effect of expenditure on student achievement over a three-year period. Variables significantly related to achievement are included in the model. At both the elementary and middle school levels, the impact of previous achievment and intelligence test results explained most of the variance. The percentage of variance explained by dollar input was minimal. Policy implications are discussed with reference to litigation and parallel research. (Author/MLF)

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THE DISTRIBUTION OF SCHOOL RESOURCES AND THEIR EFFECT UPON ACHIEVEMENT--AN INTRADISTRICT APPROACH

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THE DISTRIBUTION OF SCHOOL RESOURCES AND THEIR EFFECT UPON ACHIEVEMENT--AN INTRADISTRICT APPROACH

> Little was known until recently about resource allocation within the school district. For one thing, school districts did not collect per pupil resource data on a school-by-school basis. And recently, when such data began to be collected, most school districts guarded it jealously and didn't make it available to persons outside the system.[1]

It is well documented that the distribution of resources for the provision of public education between and within school districts is not equitable. The implications of resource variation have been debated in the context of developing a standard of equality of educational opportunity. Although many standards of equality have been advanced, no one standard has been adopted by courts, legislators, and educational policy makers.

The problem of formulating a justiciable standard is due primarily to the lack of consistent evidence relating inputs to more productive outputs (value added) from the educational process. Most standards of equality reflect the necessity to achieve equal access to resources, or to distribute resources according

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[1]Allan S. Mandel, Resource Distribution Inside School Districts (Mass.: Lexington Books, D. C. Heath & Co., 1975).

to varying levels of need. The equalization of resources therefore may or may not lead to equality of educational opportunity. The equal resource principle seeks equalization of per pupil expenditures across as well as within school districts. This belief rests on the premise that government has a responsibility to equalize per pupil expenditures regardless of the effect on educational outputs.

Although resource variation is often quite dramatic, courts have insisted on evidence relating level of input to the quality of education received. In a recent Fordham Law Review article, Edward Chin points out that "it should be noted that no court has as yet adopted an equal dollar standard. The court has broadly adopted the view that equal dollar expenditures were not the exclusive yardstick of a child's educational needs"[2] The equal needs principle recognizes that equal inputs would guarantee unequal results for children with special needs. This contention is based on the recognition that the input level may affect educational output. The argument that equal educational opportunity be defined in terms of output was a revolutionary concept; however, research could not clearly demonstrate the nature of the relationship between cost and the quality of education received.

Recent criticism on the cost-quality assumption has reflected the need for more precise measures of output in the educational process. Although highly critical of the input standard, James Coleman's attempt to establish a meaningful relationship between input and output failed. Critics of the

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[2]Edward G. H. Chin, "An Analysis and Review of School Financing Reform" Fordham Law Review, XLIV, (March 1976), 4. p. 775.

Coleman report urged that future studies on cost-quality be conducted on a longitudinal, pupil-specific basis. To accomplish this, the level of analysis began to shift from an inter-district focus to intra-district study. Building-by-building analysis provided a more critical view of possible expenditure-achievement interaction.

Litigation on intra-district resource variation to date have generally adopted the input standard of equality of educational opportunity.[3] This has been true especially where lower levels of expenditure have been related to lower socioeconomic communities served by a school. Such a relationship has been referred to in the litigation as suspect classification. This view generally supports the traditional assumption underlying the cost-quality debate; that increased levels of per pupil expenditure lead to increased educational opportunity.

The present study analyzes pupil--specific input and output data, over a three-year period (1972-1975) within a selected school district in the State of Delaware. The district under investigation is a large, suburban district, serving 17,000 students (K-12). Thirteen elementary and four middle schools are compared by level of instructional expenditure and socioeconomic status of the community served by each school. Significant variation of expenditure is evident between the schools, ranging from a low of $326 per pupil to a high of $531 per pupil. Chi Square tests revealed no significant relationship between expenditure level and socioeconomic status.

Multiple regression analysis is utilized to determine the independent effect of an array of variables believed significantly related to achievement.

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[3]Allan S. Mandel, Resource Distribution Inside School Districts (Mass.: Lexington Books, D. C. Heath & Co., 1975) p. 45.

Socioeconomic status of family (measured by father's occupation), socioeconomic status of the community served by the school (measured by a principal questionnaire instrument), student I.Q., previous achievement (measured by standardized test scores), and per-pupil expenditure are included in the regression equation and are written in linear fashion:

$$Y=a_o + B_{xi2} \ldots + B_{xin} + e$$

where: Y=achievement of the ith student

$x_{i1}, x_{i2} \ldots x_{in}$ = n explanatory variables corresponding to measurements of the variables included in the model

β values = regression or beta coefficients as parameters of the educational process.

e = residual term of portion of y that cannot be explained by the independent variables entered in the equation.

a = the intercept.

The output revealed the independent effect of each of the independent variables on achievement. At both the elementary and middle school levels, beta (β) coefficients revealed that the impact of previous achievement and I. Q. explained most of the variance (Table 1A & B). At the elementary level, (Table 1A), I. Q. and previous achievement explained 85 percent (average of all test areas) of the variance explained by the independent variables in the model. Similarly, at the middle school level (Table 1B), 87 percent (average of all test areas) of the variance was explained by I. Q. and previous achievement. Not surprisingly, the percentage of variance explained by dollar input was minimal. At both the elementary and middle school levels, only 4 percent of the variance was explained by dollar input. (Direction as indicated by simple r was negative).

TABLE 1A

Beta Coefficients - Elementary Level

(Percentage of Variation Explained by Independent Variable)

	VOCABULARY		READING		LANGUAGE		WORK/STUDY		MATHEMATICS		AVG
	β	%	β	%	β	%	β	%	β	%	
DCACH1 (previous achievement)	0.26	34%	0.24	33%	0.18	24%	0.21	31%	0.18	27%	30%
CATIQ (IQ)	0.38	49%	0.42	58%	0.42	57%	0.37	54%	0.39	58%	55%
FAOCC (SES)	0.06	8%	0.04	7%	0.09	12%	0.06	9%	0.04	6%	8%
SCHSES (SES of community served)	0.03	4%	0.01	1%	0.02	3%	0.02	3%	0.02	3%	3%
DOLLAV (school input)	-0.04	5%	-0.01	1%	0.03	4%	-0.02	3%	-0.04	6%	4%
		100%		100%		100%		100%		100%	100%

TABLE 1B

Beta Coefficients Middle School Level
(Percentage of Variation Explained by Independent Variable)

	VOCABULARY		READING		LANGUAGE		WORK/STUDY		MATHEMATICS		AVG
	β	%	β	%	β	%	β	%	β	%	
IQ73 (IQ)	0.18	19%	0.20	21%	0.24	26%	0.32	32%	0.30	30%	26%
IQ73 (previous achievement)	0.62	65%	0.63	65%	0.65	71%	0.52	51%	0.54	54%	61%
FAOCC (SES)	0.07	7%	0.06	6%	0.02	3%	0.05	5%	0.07	7%	6%
SCHSES (SES of community served)	0.08	8%	0.02	2%	0.00	0%	0.06	6%	0.01	1%	3%
DOLAVG (school input)	0.01	1%	-0.06	6%	-0.00	0%	-0.06	6%	-0.06	6%	4%
		100%		100%		100%		100%		100%	100%

Regression results similarly pointed to the negligible impact of dollar input on achievement growth. Not more than 0.1 percent of the variance could be explained by dollar input at the elementary level, and approximately 0.2 percent at the middle school level. (Negative direction as indicated by simple r). (See also correlation coefficients Appendix A1 & A2).

For each student, a predicted score $\hat{y}$ was then determined on the basis of variable input. The actual score y (measured by Iowa Tests Basic Skills and Delaware Educational Assessment Program, D.E.A.P., results) was then compared to the predicted score, giving rise to a residual value. Residuals (error factor $y-\hat{y}$) were then placed on a scattergram by school attendance, and serve as a proxy measure of school effectiveness. This technique revealed no significant pattern relating cost to quality. (See samples in Appendix B1 & B2).

Although this study concludes that incremental increases in per-pupil expenditure have no appreciable effect on achievement growth of students in the district, this does not say that massive reductions, or massive infusions of educational resources would not have significant effects. Future study is needed to assess the implications of extreme funding changes on educational outputs, as well as to analyze the effect of differential levels of input on students of varying background and ability.

The major issues addressed in the litigation on school finance include (1) whether or not arbitrary factors such as community wealth significantly affect educational quality, and (2) the extent to which the state is or is not responsible for remedying the effects of arbitrary patterns of distribution. Some litigants charge that educational quality should not vary with arbitrary factors such as community wealth. Since the provision of education is often recognized a fundamental interest of the state, the state is held responsible

for remedying the potential effects of arbitrary patterns of resource distribution. Many states have maintained that since no clear relationship between cost and quality is evident, the state should not be required to intervene unless injury is evident to a suffering class. According to this reasoning, the state has only a responsibility to provide a minimal level of education, and cannot, nor should not, try to identify and provide resource levels commensurate with student needs.

However, within a school district, the responsibility for "equalization" rests with a central administrative staff responsible to an often "uninformed" Board of Education and public. Unless a school district has identified special need areas, and objectives, resource distribution within a school district should be based on equal access to educational resources. However, most districts do not compile data on the distribution of resources within the district, and often fail to identify objectives to be served by those resources.

A theory of distributive justice, in terms of educational opportunity, should include: (1) A commitment by the local school board of education on objectives to be served by educational resources, perhaps achieved through cost-benefit analysis, zero-based budgets, P.B.B.S., etc., (2) Some evidence which demonstrates a relationship between specific inputs, and student achievement gains, and (3) A policy which relates inputs to the accomplishment of educational objectives. The fact that arbitrary factors often determine the distribution of resources within a district is clearly unjustified. The resolution of the debate on cost-quality has meaning only in terms of providing justification for any deviation from equal access to resources consistent with educational objectives.

APPENDIX A1

Correlation Coefficients - Elementary Level

	FAOCC	DCACH1	IVCABS	IREAD5	ITLNG5	ITLWS5	ITLMA5	SCHSES	DOUAV
FAOCC	1.0000								
DCACH1	0.17163	1.0000							
IVCAB5	.18467	.50100	1.0000						
IREAD5	.16535	.50080	.90460	1.0000					
ITLNG5	.19099	.44385	.83439	.83254	1.0000				
ITWS5	.16658	.44014	.82125	.84308	.81283	1.0000			
ITLMA5	.14701	.42176	.80380	.81759	.79947	.87242	1.0000		
SCHSES	.25572	.04063	.10048	.07791	.05828	.08959	.08703	1.0000	
DOUAV	.01992	.11159	.00473	.03296	-.00064	.01647	-.00595	.02578	1.0000
CATIQ	.18746	.60560	.55163	.57072	.54078	.50861	.51168	.12474	.02523

For explanation on coefficients - see Appendix C1 & C2

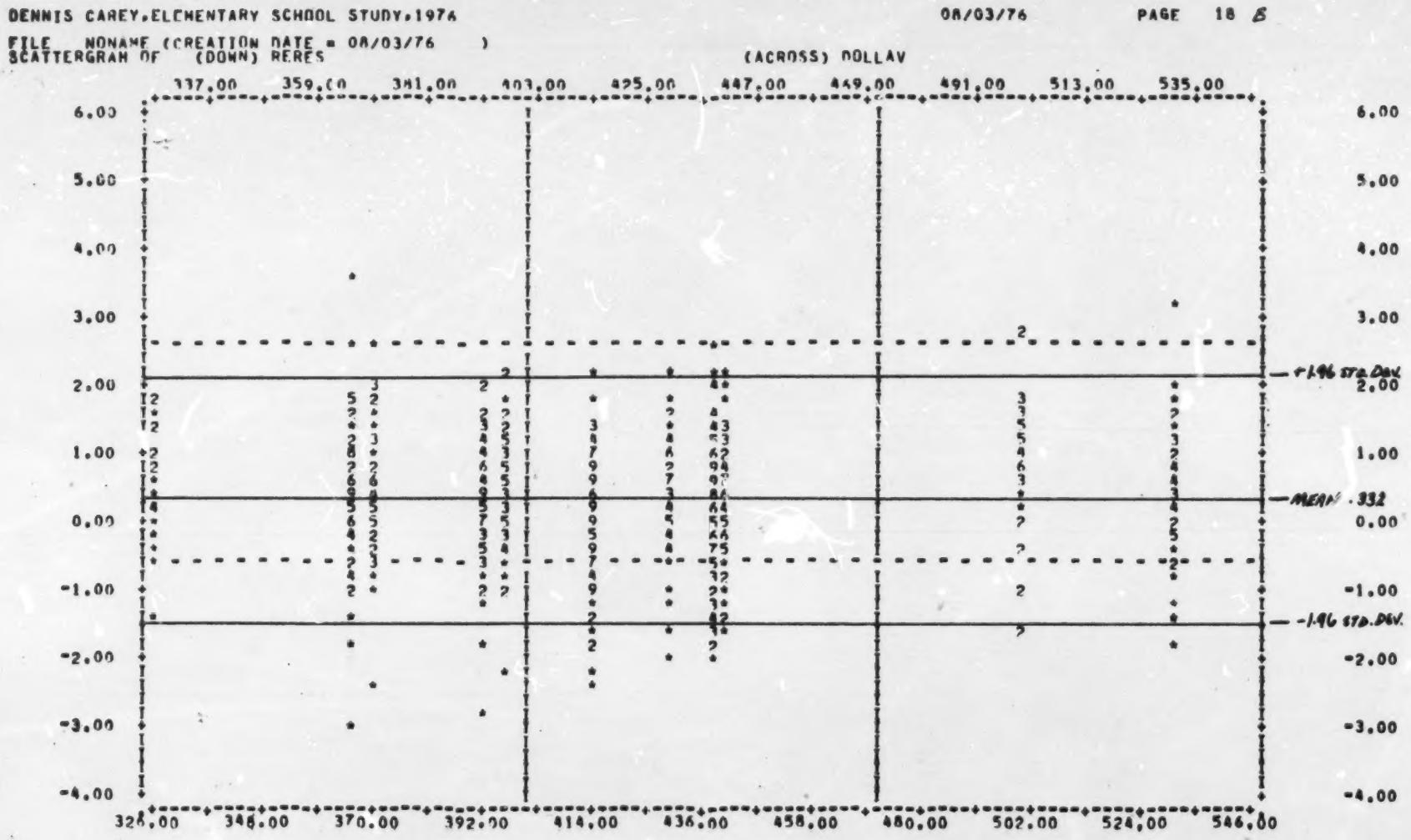
APPENDIX A2

CORRELATION COEFFICIENTS- MIDDLE SCHOOL LEVEL

	FAOCC3	IQ73	VOCAB3	READ3	LANG3	WSTUD3	MATH3	VOCAB6	READ6	LANG6	WSTUD6	MATH6	SCHSES	DOLAVG
FAOCC3	1.0000													
IQ73	.30464	1.0000												
VOCAB3	.33716	.73716	1.0000											
READ3	.36062	.73621	.81544	1.0000										
LANG3	.30134	.71872	.76146	.74793	1.0000									
WSTUD3	.35780	.76716	.76558	.79565	.76836	1.0000								
MATH3	.33254	.73920	.69533	.71243	.71251	.80639	1.0000							
VOCAB6	.35334	.67344	.79577	.77585	.69211	.71842	.63806	1.00000						
READ6	.35923	.68368	.76562	.81049	.70956	.74668	.66548	.80119	1.00000					
LANG6	.28701	.71129	.73650	.75179	.82815	.72724	.67989	.70843	.75435	1.00000				
WSTUD6	.35690	.74559	.73692	.77654	.72444	.79874	.76433	.76420	.82578	.76756	1.00000			
MATH6	.34463	.73103	.67431	.68769	.66448	.74860	.79167	.66560	.71576	.70786	.81862	1.00000		
SCHSES	.27460	.18388	.23378	.27436	.25893	.22770	.20180	.27692	.26609	.21846	.26771	.20556	1.00000	
DOLAVG	-.08492	.12098	-.10032	.10036	.07740	-.02266	.01014	.09845	-.13688	-.05364	-.08897	-.05454	-.24055	1.00000

For explanation on coefficients - see Appendix C1 & C2

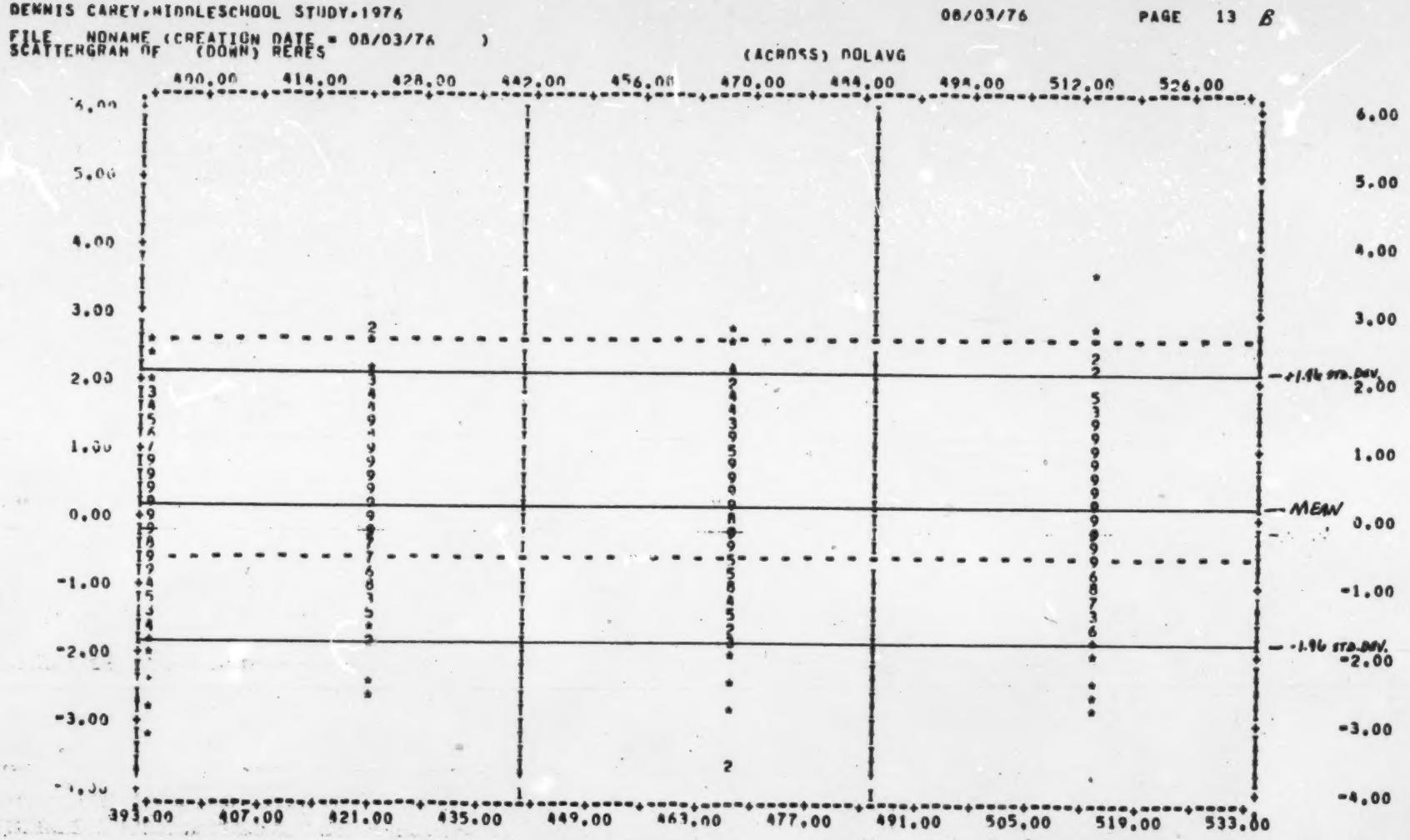
APPENDIX B1
ELEMENTARY READING RESIDUALS BY BUILDING PER PUPIL EXPENDITURE



APPENDIX B1

APPENDIX B2

Middle School READING RESIDUALS BY BUILDING PER PUPIL EXPENDITURE



APPENDIX B2

APPENDIX C1

Elementary Means And Standard Deviations

Variable	Mean		Std. Deviation	Cases
FADCC	4.7		1.5	686
DCACH1	53.7		7.2	686
IVCAB5	5.4		1.8	686
IREAD5	5.5		1.8	686
ITLNG5	5.4	5.4	1.9	686
ITLWS5	5.4	expected	1.8	686
ITLMA5	5.4		1.7	686
SCHSES	52.9		2.7	686
DOLAN	419.6		46.2	686
CATIQ	110.6		14.4	686

where:

FADCC = Father's occupation, used as a measure of individual S.E.S..

DCACH1 = First grade DEAP RESULTS, used as a measure of previous achievement

IVCAB5 = Fifth grade ITBS results for vocabulary skills

IREAD5 = Fifth grade ITBS results for reading skills

ITLNG5 = Fifth grade ITBS results for language skills

ITLWS5 = Fifth grade ITBS results for work-study skills

ITLMA5 = Fifth grade ITBS results for math skills

SCHSES = Socioeconomic status characteristics - measure of community S.E.S. served by school

DOLAV = Average expenditure (instructional) per pupil 1972-1975 inclusive

CATIQ = Cognitive abilities test results - used as a measure of I.Q. ("genetic endowment")

APPENDIX C2

Middle School Means And Standard Deviations

ariable	Mean	Std. Deviation	Cases
FAOCC3	3.0	1.0	694
IQ73	104.7	14.0	694
VOCAB3	5.6	1.4	694
READ3	5.7	1.4	694
LANG3	5.7	1.4	694
WSTUD3	5.7	1.1	694
MATH3	5.7	1.1	694
VOCAB6	8.1	1.8	694
READ6	8.2	1.8	694
LANG6	7.9	1.8	694
WSTUD6	8.4	1.6	694
MATH6	8.1	1.5	694
SCHSES	51.4	2.6	694
DOLAVG	452.9	46.5	694

where:

FAOCC = Father's occupation used as a measure of individual S.E.S. (1973)

IQ73 = Cognitive abilities test I.Q. results - 1973 grade 5

VOCAB3 = ITBS vocabulary results - 1973 grade 5

READ3 = ITBS reading results - 74.6 1973 grade 5

LANG3 = ITBS language skills results - 1973 grade 5

WSTUD3 = ITBS work/study skills results - 1973 grade 5

MATH3 = ITBS math results - 1973 grade 5

VOCAB6 = ITBS vocabulary results - 1976 grade 8

READ6 = ITBS reading results - 1976 grade 8

LANG6 = ITBS language results - 1976 grade 8

WSTUD6 = ITBS language results - 1976 grade 8

MATH6 = ITBS math results - 1976 grade 8

SCHSES = Socio-economic characteristics of community served by school

DOLAVG = Average instructional costs per pupil 1972-75 inclusive